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(71) Applicant (*for all designated States except US*): SUNDS DEFIBRATOR INDUSTRIES AKTIEBOLAG [SE/SE]; S-851 94 Sundsvall (SE).

(72) Inventors; and
(75) Inventors/Applicants (*for US only*) : DANIELSSON, K., Ove [SE/SE]; Nybergsgatan 8, S-114 45 Stockholm (SE). FALK, Bo, G., S. [SE/SE]; Avstyckningsvägen 46, S-175 43 Järfälla (SE). JACKSON, Michael [GB/CA]; 1045 Marigold Avenue, North Vancouver, British Columbia V7R 2E1 (CA).

(74) Agent: SUNDQVIST, Hans; Svenska Cellulosa Aktiebolaget SCA, Kungsgatan 33, 7tr, S-111 56 Stockholm (SE).

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(54) Title: METHOD OF MAKING CHEMI-MECHANICAL PULP FROM HARDWOOD

(57) Abstract

Manufacture of chemi-mechanical pulp from hardwood intended for wood-containing printing paper, especially wood-containing fine paper. The wood material in the form of chips is impregnated in one or two steps at a temperature below 80°C with 15-40 kg NaOH and 0-30 kg Na_2SO_3 per ton pulp. Thereafter the chips are refined under pressure, so that the temperature of the chips prior to the refining does not exceed 80°C for a time longer than ten seconds. Bleaching of the pulp with peroxide, at which bleaching at least 15 kg NaOH per ton pulp is charged additionally, so that the total amount of NaOH charge is 30-80 kg per ton pulp. After the bleaching a second refining step is carried out.

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Method of making chemi-mechanical pulp from hardwood

This invention relates to the making of chemi-mechanical pulp frøm hardwood for wood-containing printing paper, especially wood-containing fine paper.

Fine paper traditionally is manufactured from a mixture of short-fibred and long-fibred chemical pulp. In order to improve the opacity of the paper and to increase its bulk, conventionally a certain amount of bleached groundwood pulp was mixed into the stock. The term wood--containing fine paper is used when the amount of mechanical pulp exceeds 10%.

In recent years a new type of pulp, peroxide-bleached chemi-mechanical pulp of hardwood, so-called $CTMP_H$, has implied an interesting alternative as a replacement of both the groundwood pulp and the chemical hardwood pulp at the manufacture of wood-containing printing papers. Especially asp and poplar have been used therefor.

For this type of paper very high requirements are made on the properties of the $CTMP_H$-pulp, because the paper in addition to high ISO-brightness and good opacity preferably also should have high bulk and simultaneously high stremgth and low roughness. For coated papers also low porosity is required. It is especially important, that these papers have a uniform surface structure.

For being able to use $CTMP_H$-pulp in wood-containing fine paper, it must be refined to a drainage resistance of 100-200 ml CSF, and it must be possible to bleach it to a brightness of 82-85% ISO, which is a very high brightness for a mechanical pulp. The energy consumption at the refining thereby is relatively high, and so is the chemical consumption at the bleaching. This applies particularly to dark hardwood with high density and various types of eucalyptus. An extensive equipment

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in the form of means for drainage and washing is required for the bleaching.

The present invention implies, that this equipment can be simplified and the consumption of chemicals and electric energy be reduced without deteriorating the pulp quality.

According to the invention, the hardwood in the form of chips is impregnated in one or two steps at a temperature below 80°C with 15-40 kg NaOH and 0-30 kg Na_2SO_3 per ton pulp. Thereafter a refining under pressure is carried out in such a way, that the temperature of the chips prior to the refining does not exceed 80°C for a period longer than 10 seconds. Subsequent bleaching of the pulp is carried out with peroxide in one or two steps, and additionally a minimum of 15 kg NaOH is charged so that the total amount of NaOH charged is 30-80 kg per ton pulp. Thereafter refining of the pulp is carried out in a second step.

The invention implies that the brightness and light-scattering coefficient of the pulp is maximized and at the same time the energy consumption at the refining is minimized.

It is generally known that a high alkali charge during the impregnation step prior to the refining increases the light absorption coefficient and decreases the light-scattering coefficient of the pulp, i.e. decreases the brightness, but improves the strength and reduces the shives content.

According to the invention, the strength of the pulp is determined by the total of the alkali charge during the impregnation and peroxide bleaching steps.

According to the invention, the alkali charge during the impregnation step shall be determined only with regard being paid to the shives content and fibre distribution number and disregarding the pulp strength obtained by

the alkali charge during the bleaching step. As a result, the reduction in brightness and light scattering coefficient can be minimized. The refining in the second step is carried out with partially washed pulp, i.e. pulp containing residual alkali and residual peroxide from the bleaching, in order to minimize the energy demand at the refining and to be able to utilize the refining step as a third bleaching step carried out at a very high temperature, whereby it shall be possible to obtain highest brightness with a certain peroxide charge. The total peroxide charge at the bleaching shall be 30-50 kg peroxide per ton pulp, preferably 30-40 kg for light wood types and 40-50 kg for dark ones.

The characterizing features of the invention become apparent from the attached claims. The invention is described in the following with reference to an embodiment thereof and experiment results shown in the accompanying Figures, of which

Fig. 1 shows the ISO-brightness after peroxide bleaching as a function of the NaOH-charge during the impregnation step, and

Fig. 2 shows the tensile strength of the pulp as a function of the total NaOH-charge.

The pretreatment of the hardwood in the form of chips of eucalyptus saligna is carried out by washing, atmospheric steaming and so-called PREX-impregnation with a $NaOH/Na_2SO_3$-solution with pH 13. By the impregnation, 20 kg NaOH and 20 kg Na_2SO_3 per ton are supplied to the chips. The chemicals are allowed to react for 30 minutes with the chips which hold $50^{\circ}C$.

The chemicals and solved substance are thereafter pressed out of the chips, which are pressure refined with 1000-1200 kWh/ton at a steam pressure of 3,5 kg/cm^2 in the refiner house to a dewatering number measured as 350 ml CSF. The energy input at this refining should

be 800-1400 kWh/ton

The pulp is diluted and dewatered to 35% pulp concentration and thereafter mixed with complex former, preferably EDTA, at pH 5, thereafter diluted and again pressed to 35% dry matter content.

The pulp is thereafter peroxide bleached in two steps, the first one at 15-18% pulp concentration with residual peroxide from the washing following after the second bleaching step. After the first bleaching step, which is carried out at 70°C for 30 minutes, the pulp is again washed and pressed to 35% dry matter content, at which content the fresh bleaching chemicals are mixed into the pulp. The pulp is bleached for 120 minutes at 70°C with 40 kg peroxide, 25 kg NaOH and 30 kg sodium silicate Na_2SiO_3 per ton pulp, whereafter the pulp is washed by dilution with 4,5 parts washing water and pressing to 35% dry matter content. The pulp is refined in a pressurized disc refiner,together with reject from the screen room, with 600 kWh/ton, with 3.5 kg/cm^2 steam pressure and simultaneous addition of 5 kg peroxide per ton pulp to the refiner inlet. The energy input at this refining should be 400-800 kWh/ton. The pulp is latency treated at 3.5% pulp concentration and 70°C, screened in pressurized screens in two steps and thereafter pumped to storage before being used in a paper mill.

After the different reaction steps, the pulp has the properties as follows:

<u>After the first refining step</u>

Freeness	350 ml CSF
Fibre length acc. to Bauer Mc Nett + 16	1%
16/30	8%
- 200	20%
Light scattering coefficient	48 m^2/kg
ISO-brightness	45%

After the second bleaching step

Freeness	325 ml CSF
Light scattering coefficient	48 m^2/kg
ISO-brightness	80%

After the second refining step

Freeness	160 ml CSF
Fibre length acc. to Bauer Mc Nett +16	0%
16/30	5%
-200	83%
Light scattering coefficient	50 m^2/kg
ISO-brightness	82%

After the screening room

Freeness	125 ml CSF
Fibre length acc. to Bauer Mc Nett + 16	0%
16/30	2%
-200	24%
Tensile index	40 Nm/g
Tear index	4.5 mNm^2/g
Light scattering coefficient	50 m^2/kg
ISO-brightness	82.5%

Different NaOH-charges during the impregnation step result in different ISO-brightness of the pulp after the peroxide bleaching.

A lower NaOH-charge implies, that it is possible to obtain a higher final ISO-brightness of the pulp. In Fig. 1 is shown how the brightness varies with the NaOH--charge during the impregnation step at three different peroxide charges.

Pulp I was manufactured from chips, which had been impregnated with 25 kg NaOH per ton pulp. With a peroxide charge of 45 kg per ton pulp it is then possible to obtain a brightness of above 80% ISO.

Pulp II was manufactured from chips impregnated with 50 kg NaOH per ton pulp.In spite of bleaching with a peroxide charge as high as 45 kg per ton pulp, it is not possible to increase the brightness higher than to about 77% ISO.

At the embodiment described above the original NaOH--charge was 20 kg per ton pulp. The brightness could there be increased by peroxide bleaching to 82.5% ISO.

A lower NaOH-charge at the chip impregnation, however, results in a decrease of the strength properties of the pulp. It was found, however, that the pulp strength within certain limits depends only on the total NaOH-charge during the impregnation and peroxide bleaching steps. During the impregnation step, therefore, NaOH is charged in an amount of 15-40 kg per ton pulp in order to ensure the necessary shives content and fibre distribution number. Additional NaOH in an amount of at least 15 kg per ton pulp to a total amount of 30-80 kg per ton pulp is charged first in connection with the peroxide bleaching after the first refining. As regards the NaOH-charge can be said, that heavy and dark wood types, such as eucalyptus, require more alkali for the development of their strength than wood types, which are lighter and brighter, such as asp and poplar. Against this background, the NaOH-charge for the heavier and darker wood types should be 20-40 kg and for the lighter and brighter ones 15-25 kg per ton pulp. The total NaOH-charge should be 40-80 and, respectively, 30-50 kg per ton pulp.

In Fig. 2 is shown how the tensile strength of the pulp changes with the total amount of NaOH charged and peroxide bleaching with 45 kg peroxide per ton pulp. Freeness 125 ml CSF.

It is, thus, possible at the peroxide bleaching by means of an additional NaOH-charge to increase the tensile

strength of the pulp I to a level very close to the tensile strength of pulp II, i.e. about 45 Nm/g.

One prerequisite for being able to increase the strength properties of the pulp in this way, hovever, is that the original NaOH-charge during the impregnation step is at least 15 kg NaOH per ton pulp, see above.

The invention, of course, is not restricted to the embodiments described above, but can be varied within the scope of the invention idea.

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Claims

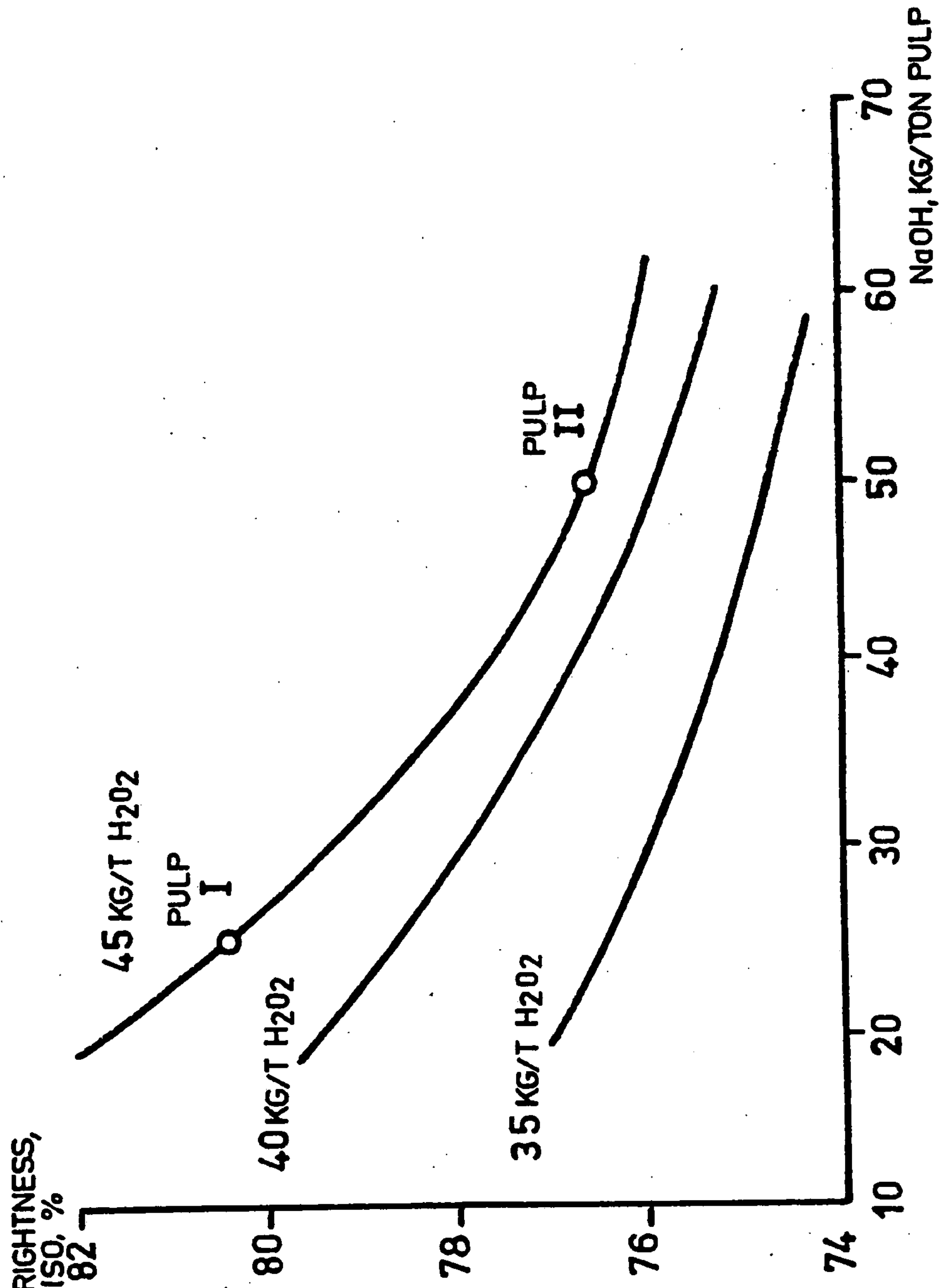
1. A method of manufacturing chemi-mechanical pulp from hardwood for wood-containing printing paper, especially wood-containing fine paper, c h a r a c t e r i z e d i n that it comprises the combination of the steps
a) impregnation of the wood material in the form of chips in one or two steps at a temperature below 80°C with 15-40 kg NaOH and 0-30 kg Na_2SO_3 per ton pulp;
b) refining of the wood chips in a first step under pressure, so that the temperature of the chips prior to the refining does not exceed 80°C for a time longer than 10 seconds;
c) bleaching of the pulp with peroxide in one or two steps, at which at least 15 kg NaOH is charged additionally so that the total amount of NaOH charged is 30-80 kg/ton pulp;
d) refining of the pulp in a second step.

2. A method as defined in claim 1, c h a r a c t e r i z e d i n that the peroxide bleaching is carried out with a total charge of 30-50 kg peroxide per ton pulp.

3. A method as defined in claim 1 or 2, c h a r a c t e r i z e d i n that 5 kg peroxide per ton pulp of the total peroxide charge is added during the second refining step.

4. A method as defined in any one of the claims 1-3, c h a r a c t e r i z e d i n that the first refining step is carried out with an energy input of 800-1400 kWh/ton pulp, and the second one with 400-800 kWh/ton pulp.

FIG.1


BRIGHTNESS, ISO, %
82
80
78
76
74
10
20
30
40
50
60
70
NaOH, KG/TON PULP
45 KG/T H_2O_2
40 KG/T H_2O_2
35 KG/T H_2O_2
PULP I
PULP II

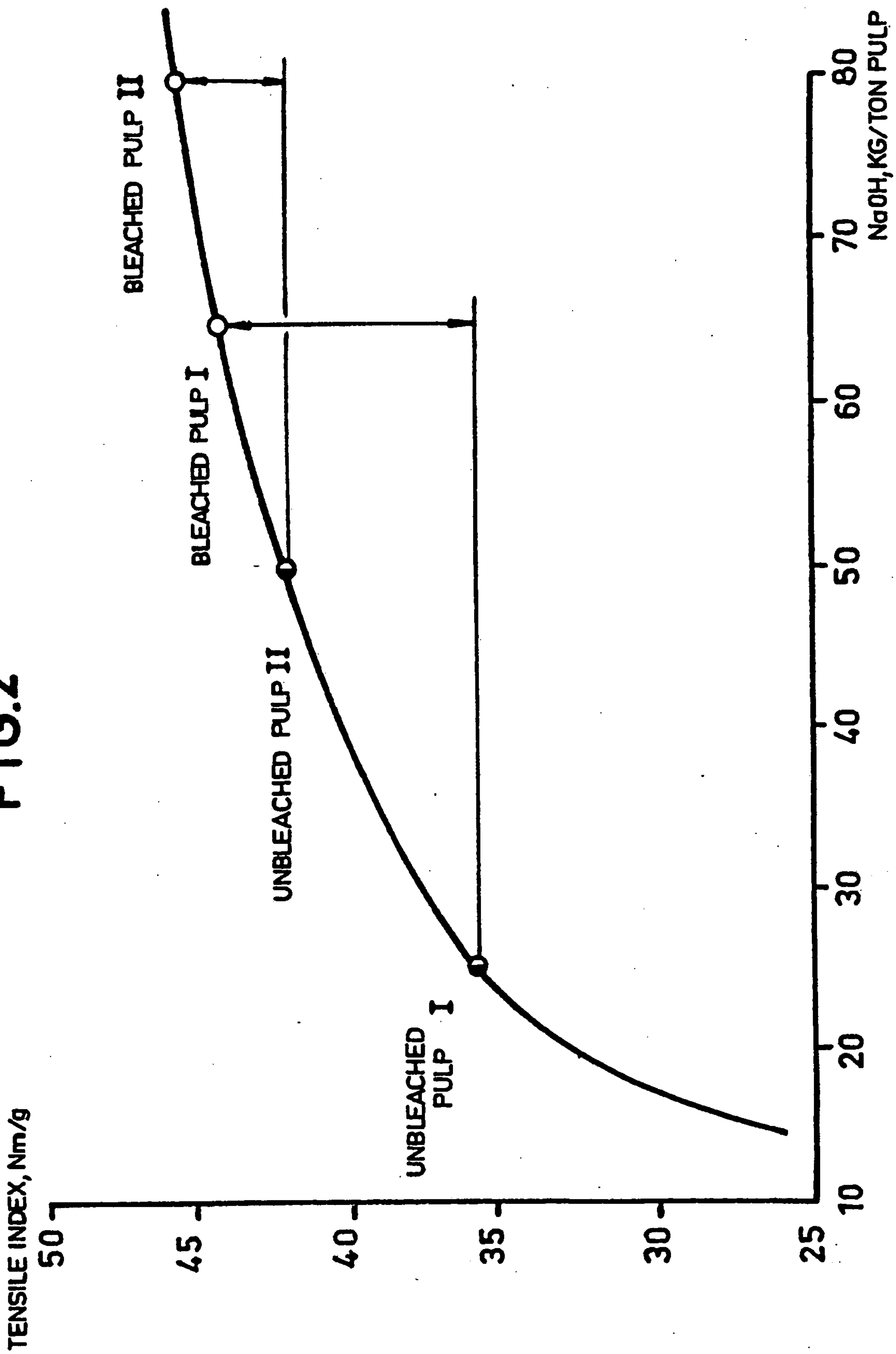

TENSILE INDEX, Nm/g
50
45
40
35
30
25
10
20
30
40
50
60
70
80
NaOH, KG/TON PULP
UNBLEACHED PULP I
UNBLEACHED PULP II
BLEACHED PULP I
BLEACHED PULP II

FIG.2

INTERNATIONAL SEARCH REPORT

International Application No PCT/SE89/00395

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC 4

D 21 B 1/02, D 21 C 3/26

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC 4	D 21 B; D 21 C
US Cl	162

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

SE, NO, DK, FI classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	SE, B, 454 186 (EKA NOBEL AB) 11 April 1988	
A	WO, A1, 87/03022 (SUNDS DEFIBRATOR AKTIEBOLAG) 21 May 1987	
A	US, A, 4 294 653 (JONAS A.I. LINDAHL ET AL) 13 October 1981	
A	US, A, 4 718 980 (LEONARD E. LOWRIE ET AL) 12 January 1988	

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IV. CERTIFICATION

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